

have made it possible to take the three negatives necessary for their method of colour photography in three seconds, including the time required for changing the plates and light filters, when the light is only moderate and the lens aperture $f/16$. In the central court, besides a great deal of apparatus and several demonstrations of processes, the Adhesive Dry Mounting Co. shows its method of mounting by warm pressure. The Ozotype Co. shows in the north room several examples of "ozobrome" prints. These are quite a new departure, a carbon print being produced by means of a bromide print without exposure to light, the silver image in the bromide print reducing the bichromate in the carbon tissue by mere contact. The original bromide prints and the carbon copies are shown side by side. C. J.

GEODETIC OPERATIONS IN SOUTH AFRICA.

IT will be admitted that the Administration of Southern Rhodesia acted wisely in accepting the timely counsel which Sir David Gill brought under its consideration. Some ten years ago His Majesty's Astronomer at the Cape pointed out to Lord Grey, who then administered the government of the colony, the desirability of basing the land tenure on a properly established system of survey. The adoption of such a course would not only afford the means of supplying a sound and incontrovertible evidence of title to the possessor, but would protect the Government against the perpetration of fraud and tend to diminish future litigation. Sir David Gill does not hesitate to say that in Cape Colony large tracts of land have been stolen from the Government, either through the wilful shifting of beacon marks or from carelessness due to inadequate surveying. Sir David Gill did not lay any great stress upon the scientific value that necessarily attaches to accurate measurement conducted on a large scale; but this point was not neglected, and the work was planned so as to give the greatest assistance to economic requirements, and at the same time to forward scientific interests. The one purpose was effected by carrying a chain of triangles eastwards from Bulawayo, covering the most thickly populated and important parts of the country, the other by extending the chain north and south along the thirtieth meridian, so that it might form part of the great arc of meridian which it is proposed to extend from the south of Natal to the Mediterranean. The actual district surveyed extends from about 16° to 20° south latitude and from 28° to 31° east longitude.

Sir David Gill sketches the history of the work accomplished in successive years, from which can be gathered something of the difficulties which Mr. Simms and his assistants encountered and overcame. Abnormally wet seasons, illness among the staff, the necessary burning of the grass and the rising of the smoke preventing the measurement of horizontal angles, loss of cattle, and in one instance the destruction of the theodolite, are a few of the troubles that beset those who attempted geodetic operations in an unsettled country; but, notwithstanding these drawbacks, there remained only three stations south of the Zambezi which were not fully connected with the scheme of triangulation proposed. As the work is extended northwards these stations will be occupied, and thus form a useful link in the two systems.

A matter of great interest in the report from a scientific point of view consists in the critical examination of the Jäderin wires used in the measurement of the base lines. This apparently convenient form of measurement was, it is believed, adopted by the Russian geodesists in the work connected with the Spitsbergen base, but in this country the apparatus has not been submitted to any very thorough test, and figures for the first time on a large scale in the geodetic survey of South Africa. Two wires, one of steel and the other of brass, constitute a "pair," and, as a rule, were used in this form. Each wire is about 1.65 mm. in diameter, and is stretched by an accurate spring balance with a tension of 10 kilograms. The length of three pairs

was each 80 feet, but two others of 160 feet and 320 feet respectively were used in crossing streams and gulleys. Another form of the same apparatus, occasionally used, consisted of a wire of "invar" nickel-steel and a wire of another alloy having a coefficient of expansion about the same as that of brass. The absolute length of each of these pairs was determined by repeated comparisons with a base line 80 feet in length, measured with a standard bar apparatus; but even the length of this base could not be assumed to be constant. The partially decomposed quartzose slate beneath the piers which carried the fiducial marks appeared to change slightly in position, especially after rain, and the length of this base as measured in the wet and dry seasons differed by half a millimetre. Constant measurement with the bars removed any source of error from this cause, since the change of length between the beginning and end of a set of wire comparisons was practically insensible.

But the real source of error in the use of the Jäderin wires lies in the fact that the ordinary steel and brass wires are liable to change of length, due to re-arrangement of the molecules of the constituent metals which takes place independent of temperature after these molecules have been violently disturbed. The tendency in all new drawn wires is to shorten, very markedly at first, and to diminish in amount as a more stable arrangement of the molecules is established. In a postscript, however, it is stated that, as the result of experiments conducted at the International Bureau of Weights and Measures, it is found possible by careful annealing and special mechanical treatment to render the arrangement of the constituent molecules of "invar" wires practically stable, and that such wires can be used as standards. Such wires, however, are not examined here. As an evidence of the change of length in the wires actually used, we may quote the following:—The length of a standard pair, at a temperature when both components were of equal length, was found to be in

April and May, 1898 24382.07 mm.

October and November, 1898 24381.84 "

Two base lines were measured in the course of the work, one of $11\frac{1}{2}$ miles and the other of $13\frac{1}{2}$ miles. The first, known as the Inseza base, was measured in three sections, the second in seven, each section being measured in opposite directions. As an indication of the accuracy attained we give the repeated measures in the shorter base:—

	Direct	Reverse	Discordance
	mm.	mm.	
Length of Section I.	4,509,571.88	4,509,554.47	1 in 259,000
" " II.	6,200,765.86	6,200,732.18	1 " 184,000
" " III.	8,196,927.19	8,196,928.28	1 " 4,746,000
TOTAL ...	18,907,264.93	18,907,214.93	1 in 378,000

We have not space to quote the results in the case of the Gwibi or longer base, but the results there are even more accordant, the average discrepancy amounting to only one in a million and a half.

W. E. P.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE celebration of the four hundredth anniversary of the foundation of the University of Aberdeen began on Tuesday, and will continue for several days. The commemoration has been planned on a magnificent scale, and the arrangements have been perfectly organised. The formal proceedings opened on Tuesday morning with a service at King's College in commemoration of the founding of the University by Bishop Elphinstone. In the afternoon, at a reception given by the Chancellor (Lord Strathcona) and other high officers of the University, the delegates of the British, colonial, and foreign universities were presented to the Chancellor and delivered their addresses. In the evening a banquet was given by the Lord Provost and the corporation. Among the distinguished foreigners who are taking part in the celebrations are:—Prof. H. Becquerel, Prof. Behring, Dr. C. De

¹ Report of the Geodetic Survey of part of Southern Rhodesia executed by Mr. Alexander Simms, Government Surveyor, under the direction of Sir David Gill, K.C.B., F.R.S., His Majesty's Astronomer at the Cape. Pp. xiv + 146. (Cape Town, 1905.)

Candolle, Prof. Deissmann, Prof. Yves Delage, Dr. Anton Dohrn, Prof. A. Giard, Prof. H. Höfding, Prof. F. Hueppe, Prof. Jensen, Prof. Lombroso, Prof. Matsumura, Prof. Mendeléeff, Prof. Menschutkin, Prof. Hugo Münsterberg, Prof. W. Ostwald, Prof. Giuseppe Veronese, Prof. Paul Vinogradoff, Prof. J. W. Wijhe, and Prof. Weichselbaum. The lecture-rooms, laboratories, and other buildings which will be opened by the King to-day have cost more than 200,000*l.* to erect and equip. The new block completes the quadrangle, and includes new class-rooms and laboratories for physiology, geology, and agriculture; new rooms for education, medicine, modern languages, and other subjects; a new library for scientific literature, and new offices. We hope to give in our next number a description of this extension of the University, and an account of the brilliant ceremonies with which it has been inaugurated.

THE next session of the South-Eastern Agricultural College, Wye, will commence on October 1, and the inaugural address will be delivered by Dr. H. E. Armstrong, F.R.S., on October 2. A conference of fruit growers will be held at the college on October 22, when discussions on methods of planting, fungus diseases, insect attacks, strawberry culture, will be opened by Messrs. S. U. Pickering, F.R.S., E. C. Salmon, F. V. Theobald, and W. P. Wright. The chair will be taken by Mr. Laurence Hardy, M.P. Those wishing to attend the conference should send their names to the principal of the college.

ON October 11 Sir William Anson will distribute the prizes awarded to students in the evening classes of the Royal Technical Institute, Salford. The calendar of the institute for the session 1906-7 contains the announcement that all intending students under sixteen years of age will, before admission to the evening classes, be required to pass an entrance examination in elementary mathematics and English, or to satisfy the principal that they possess the requisite preliminary knowledge. Those who do not possess the knowledge necessary to pass the entrance examination are recommended to join one of the evening schools which have been instituted in various parts of Salford, and at which the required preparation is provided. It is intended that next year all under seventeen years of age shall furnish evidence of the possession of the requisite preliminary knowledge.

In the early days of the movement for the higher education of women, one of its most active workers was Mrs. William Grey, whose death on September 19 at the advanced age of ninety years was announced in the *Times* of September 21. Mrs. Grey's name was from the first well known among those who advocated and carried to a successful result the foundation of high schools for girls by combined private effort; and the Girls' Public Day School Company (Ltd.) was the outcome of this movement. Springing out of the needs presently revealed by the high schools came the establishment of a system of training for secondary teachers. The idea was then comparatively new in England, and public opinion on the subject had to be formed and fostered, as it was largely through the work of Mrs. Grey. In recognition of her labours the well-known Maria Grey Training College for Women, now situated at Brondesbury, was named after her.

AN inspiring address on educational methods and their relation to science and industry, with particular reference to pottery, was delivered by Prof. H. E. Armstrong in the Town Hall, Longton, on September 19. In the course of his remarks, he said that workers in science have evolved a method, the scientific method, involving the gradual and cautious passage from the known to the unknown. Workers in politics have no such method at their disposal. Too often they are more or less ignorant of the real nature and extent of the problems which they deal with and seek to solve; sentiment masters their actions. The application of scientific method to public affairs is, consequently, becoming a matter of paramount importance. In all manufacturing districts science and industry must be brought into an effective alliance. On no other basis are prosperity and happiness possible, for the simple reason that, in these

days, an industry that does not repose on a scientific basis is one which has no proper knowledge of itself, science being nothing more than organised systematic knowledge. Scientific training, training in method, is required by all. Scientific knowledge, true knowledge, must be public possession. The feeling is becoming general that something must be done to make our schools more effective than they are. In a recent report of the Consultative Committee, the Board of Education is advised that the schools have failed, in the past, to develop both the moral and mental qualities which are desirable, and that we must now strive to make the teaching far more practical, manual training being openly and strongly advocated. We read, moreover, "It would seem clear to the committee that the thing needed is not only knowledge, but a right attitude of mind, a mind confident in its own power to observe and think, and in the habit of observing and thinking—a mind in which interest makes for intelligence and intelligence for interest." "The course," it is stated, "should consist of three threads or strands, roughly to be termed humanistic, scientific, and manual, and, in the case of girls, domestic; all higher elementary schools should give this threefold instruction." Though these views have been urged by many educational reformers for thirty years or more, the doctrine they involve is really quite revolutionary coming from such a quarter, especially as it is directed to the Board of Education, which treats manual training as a special subject for the select few.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 14, 1905.—"Observations on the Development of *Ornithorhynchus*." By Prof. J. T. Wilson and Dr. J. P. Hill. Communicated by Sir William Turner, K.C.B., F.R.S.

The paper treats of certain stages in the intra-uterine development of the egg of *Ornithorhynchus*. The following are points of more special interest among those set forth in the extended paper:—

(a) The very early differentiation of the layer of yolk-entoderm surrounding the yolk-mass of the monotreme egg.

(b) The original entire independence of the primitive streak from the primitive knot and its "gastrulation-cavity."

(c) The subsequent intimate approximation of these structures.

(d) The early appearance of an area of special differentiation in the vicinity of the primitive streak in the early blastoderm, and the later conversion of this "primitive-streak-area" into an "embryonic area" proper, by the annexation of the region surrounding the "primitive" or "archenteric" knot.

(e) The precise mode of disappearance of the ventral wall or floor of the archenteric- or invagination-cavity.

(f) The occurrence of peculiar segmental cell-masses in the substance of the "primitive knot," where that constitutes the parietes of an archenteric canal or its representative.

(g) The diagrammatically clear demonstration of various features of neural development, including the well-marked neuromeric segmentation of the cephalic region of the flattened medullary plate, the differentiation of early plate-like ganglionic expansions of the neural crest in the cephalic region, the presence of various cellular connections between the cephalic ganglionic plates and certain of the neuromeric segments of the medullary plate.

(h) The relative insignificance of the "archencephalic" subdivision of the cephalic portion of the medullary plate, from which the fore-brain and most, if not all, of the mid-brain are derived.

June 28.—"Note on the Production of Secondary Rays by α Rays from Polonium." By W. H. Logeman. Communicated by Prof. J. J. Thomson, F.R.S.

The author describes results which were obtained in the course of some experiments on the slowly-moving negative